

Banks School Road Stream and Wetland Mitigation Site Plan Lenoir County

R-2719A WBS ELEMENT: 34501.1.1

January 8, 2008

NCDOT will perform on-site mitigation to offset unavoidable stream and wetland impacts associated with Transportation Improvement Program (TIP) R-2719A. The mitigation involves two sites that occur within the NCDOT right-of-way adjacent to this TIP within NCDWQ sub-basin 03-04-05 and within HU 03020202 (Exhibit 1). Site 1 consists of 2,077 ft. of an unnamed tributary to Falling Creek located along the US Highway 70 corridor in Lenoir County, just west of Kinston and the intersection with US Highway 258. Site 2 is a 21.28 acre site south of Banks School Road near the intersection with Ridgewood Drive.

At Site 1, the proposed mitigation will restore approximately 2,438 feet of stream using Rosgen Priority Level II restoration as well as 3.81 acres of riparian buffer. This will be used as onsite stream mitigation at a ratio of 1:1 to offset stream impacts associated with R-2719A.

At Site 2, the proposed mitigation will restore approximately 0.68 acres of non-riverine wetlands and 2.1 acres of riparian buffer. This will be used as onsite mitigation at a ratio of 1:1 to offset impacts associated with R-2719A. Site 2 will also provide 5.99 acres of wetland preservation and enhancement and preservation of 13.01 acres of non-jurisdictional uplands. This will be used as onsite mitigation to offset channel impacts at Site 6, as discussed with the Merger team and shown in the impact summary tables.

SITE 1: EXISTING CONDITIONS

At Site 1, UT to Falling Creek flows in a straightened ditch between row crop fields. The stream has been channelized and is often dredged and mowed as part of the normal farm operations. Channel erosion is slight to moderate; primarily because the stream gradient is low (valley slope is 0.0006). The stream is classified as a Rosgen G-type channel. The project reach has highly degraded habitat quality over its length. The section targeted for restoration extends 2,077 feet from sixty feet below a property line to the point where the channel enters a farm road culvert within the Highway 70 right-of-way.

One ephemeral drainage ditch connects to the existing channel from a field border to the south. An intermittent drainage ditch connects to the existing channel from a row crop field to the north. The proposed roadway corridor will intersect Site 1 at this location so the drainage ditch will not be incorporated in the restoration work.

The project reach is dominated by shallow pools and has very minimal riffle habitat. The riffle/pool ratio of the stream is approximately 10/90. The streambed consists mainly of fine sand and detritus. The drainage area for Site 2 is 0.5 square miles. The bankfull discharge is

estimated to be 5.0 cfs. Existing condition geomorphology parameters and measurements are provided in Appendix A.

SITE 1: PROPOSED CONDITIONS

The Coastal Plain regional curve was used to select the design bankfull dimensions. This regional curve was developed using bankfull measurements by EcoScience (Sweet and Geratz, 2003) and Baker Engineering on 18 reference streams. The bankfull cross-sectional area for a Coastal Plain stream with this drainage area of 0.5 square miles is estimated to be 8.0 square feet (Figure 1). The design bankfull width-to-depth (W/D) ratio was derived from sand bed reference reaches and an analysis of sediment transport capacity. W/D ratios and slopes from reference sites used to develop the Coastal Plain regional curve were plotted and used to select the ratio for the project reach (Figure 2). This plot suggests a W/D ratio of 11 is appropriate, especially considering that the lower W/D ratio will increase stream power, which is lacking in the existing conditions due to the low slope. A bankfull cross-sectional area of 8.0 square feet and a W/D ratio of 11 yield a bankfull width of 9.4 feet and a mean bankfull depth of 0.9 feet.

Belt width ratios for Coastal Plain reference channels typically range from five to eight times bankfull width. A belt width ratio of 5.3 was selected for the project site because this limited the amount of excavation to create a floodplain bench. The floodplain bench will be extended 15 feet beyond the meander bends of the proposed channel; this yields an entrenchment ratio of 8.5. Radius of curvature ratios from 2.3 to 3.1 are proposed for the project site. These radii produced meander length ratios of 12 to 15, which are within the range commonly seen in reference E-channel streams. Based on an alignment designed with the listed parameter values, the design sinuosity will be 1.2. Proposed morphological characteristics are presented in Appendix A.

The proposed stream channel design yields a stream power estimate of 0.23 W/m^2 (Table 2), which is a 15 percent increase over that of the existing channel, which is 0.20 W/m^2 . This is a very low level for stream power but the sediment supply is presently also low so the design stream should provide sufficient capacity. This is supported by NC sand bed reference reach data that shows comparable stream power in streams with low slopes (Figure 3). Competency and shear stress were not considered for design purposes because the fine-grained bed material can be easily transported.

The proposed stream alignment and right-of-way is shown in Exhibit 2. The proposed right-of-way easement is estimated to be 6.2 acres. The stream banks will be planted with live stakes on 3-foot centers. The buffer will be replanted with bare root seedlings at 680 trees per acre. At outside meander bends, the minimum buffer width will be 45 feet from the top of bank. At these locations, at least 85 feet of buffer will be established on the opposite streambank. Selected species for re-vegetation are presented in Table 3.

SITE 2: EXISTING CONDITIONS

Site 2 consists of 17.36 acres of non-jurisdictional upland area and 3.92 acres of wooded jurisdictional wetlands. The parcel is drained by several ditches, leaving hydric soils that lack wetland hydrology. The soils are Pocalla in the upper area, Torhunta in the middle, and Portsmouth in the lower area (USDA, 1977). Pocalla is a hydric B list soil, while Torhunta and

Portsmouth are hydric A list soils. The proposed roadway corridor will cross the site along the eastern boundary.

SITE 2: PROPOSED CONDITIONS

The two main ditches that enter the area will be plugged, and above the plugs, shallow distribution ditches will be constructed parallel to the contour of the slope. The eastern ditch will follow the contour at an elevation of approximately 70 feet above mean sea level and the western one will follow the contour at an elevation of approximately 69 feet. The down slope banks of the ditches will be reinforced to discourage new drainage channels from forming. The distribution ditches will be one foot deep and will act as level spreaders following storms, allowing runoff to spread across the area below. During dryer times, water will pond in the ditch and seep into the slope below. The overflow and saturated conditions will help to raise the water table downhill from the ditch. This will improve the wetland hydrology over a broad area and restore such hydrology to areas that are currently drained, resulting in restoration of 0.68 acres of non-riverine wetlands and enhancement of 2.07 acres of wetlands. Additionally, Site 2 will provide 2.1 acres of riparian buffer restoration, 3.92 acres of jurisdictional wetland preservation, and 13.01 acres of non-jurisdictional upland preservation (Exhibit 3). The wetland and riparian buffer restoration areas will be planted with mix of bare root saplings as described in Table 3 at a rate of 680 trees per acre.

SUCCESS CRITERIA AND MONITORING PLAN

An as-built report will be submitted within 60 days of completion of the project. The as-built report will document changes in the dimension, pattern, profile, vegetation plantings, and structures of the constructed channels. The following components of Level 1 stream restoration monitoring will be performed each year of the 5-year monitoring period: reference photos, visual inspection of channel stability, and plant survival. Specific problem areas and proposed/required remedial action will be identified. Physical measurements of channel stability/morphology will not be performed. For the restored wetlands, visual inspection and photo points will be performed for three years to assure planted areas re-attain jurisdictional status.

REFERENCES

Sweet, W.V. and Geratz, W., 2003. Bankfull Hydraulic Geometry Relationships and Recurrence Intervals for North Carolina's Coastal Plain. *Journal of the American Water Resources Association*. 39(4):861-871.

U.S. Department of Agriculture, 1977. Lenoir County Soil Survey. Natural Resources Conservation Service (NRCS), Soil Survey Division.

TABLE 1. SITE INFORMATION

Mitigation Site	Project Roadway Station	Mitigation Type	Quantity
Site 1	-L- ST STA 105+00	Stream Restoration	2,438 ft
Site 1	-L- ST STA 105+00	Buffer Restoration	3.81 acres
Site 2	-Y1- TS STA 38+22.20	Wetland Restoration	0.68 acres
Site 2	-Y1- TS STA 38+22.20	Buffer Restoration	1.60 acres

TABLE 2. PROPOSED DESIGN PARAMETERS

Bankfull Discharge (cfs)	5.0
Bankfull Cross Sectional Area, Abkf (sq ft)	8.0
Bankfull Width, Wbkf (ft)	9.4
Bankfull Mean Depth, Dbkf (ft)	0.9
Width/Depth Ratio, W/D (ft/ft)	11
Wetted Perimeter, WP=W+2D (ft)	11.2
Hydraulic Radius, R=Abkf/WP (ft)	0.7
Average Channel Slope, Se (ft/ft)	0.0005
Boundary Shear Stress, τ (lb/sq ft)	0.02
Stream Power (W/m^2)	0.23

TABLE 3. PROPOSED BARE-ROOT AND LIVESTAKE SPECIES

Common Name	Scientific Name	Percent Planted by Species
Type II Streambank Reforestation – Bare Root Plantings		
River Birch	<i>Betula nigra</i>	30%
Green Ash	<i>Fraxinus pennsylvanica</i>	30%
Overcup Oak	<i>Quercus lyrata</i>	20%
Swamp Chestnut Oak	<i>Quercus michauxii</i>	20%
Type I Streambank Reforestation - Live Stakes		
Elderberry	<i>Sambucus canadensis</i>	50%
Silky Dogwood	<i>Cornus amomum</i>	50%

TABLE 4. MITIGATION SUMMARY.

Approach	Credit Ratio	Proposed Length/Area	Proposed Credits
Stream Restoration	1:1	2,438 feet	2,438
Riparian Buffer Restoration (Site 1)	1:1	3.81	3.81
Wetland Restoration	1:1	0.68 acres	0.68
Riparian Buffer Restoration (Site 2)	1:1	2.1 acres	2.1 acres

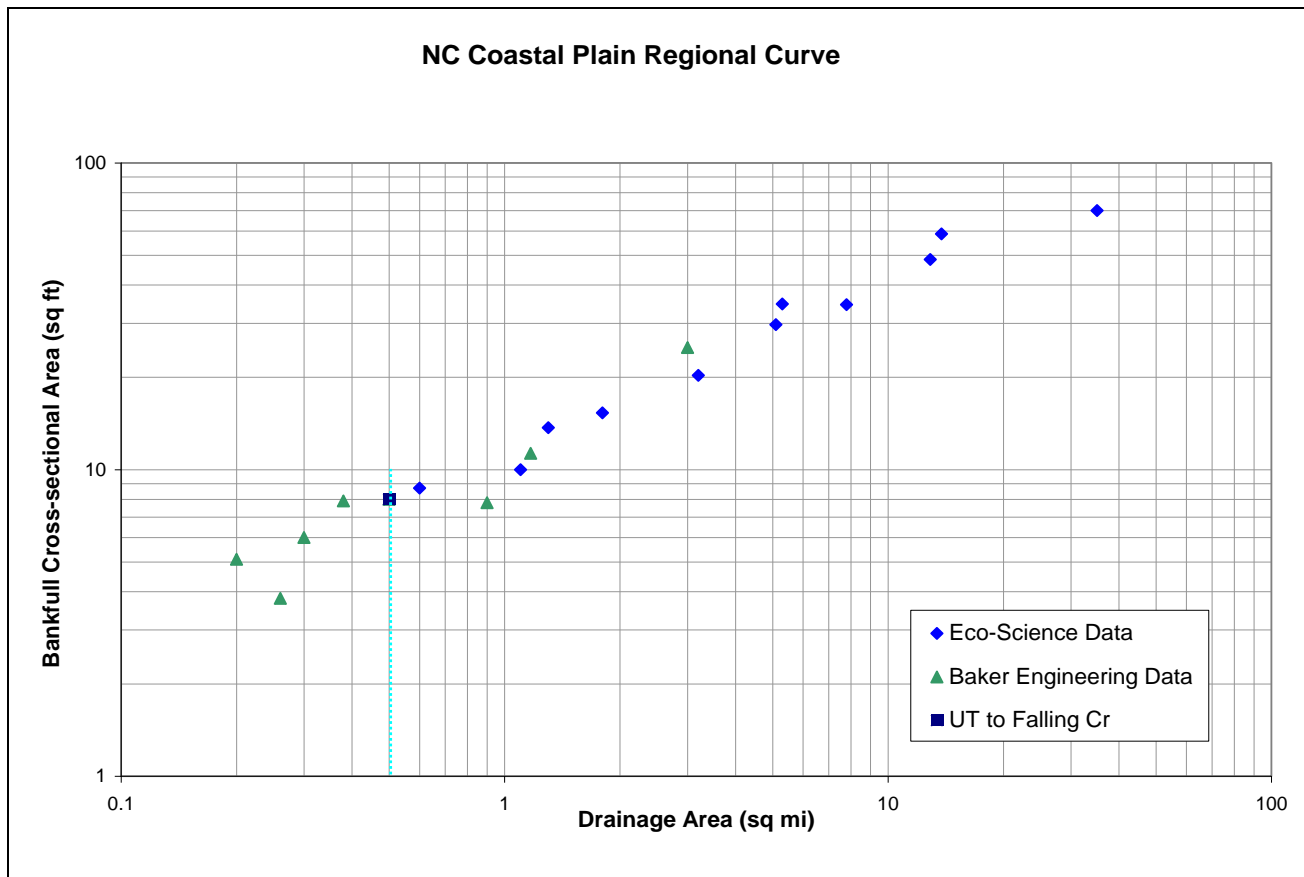


FIGURE 1. PROJECT REACH ON REGIONAL CURVE.

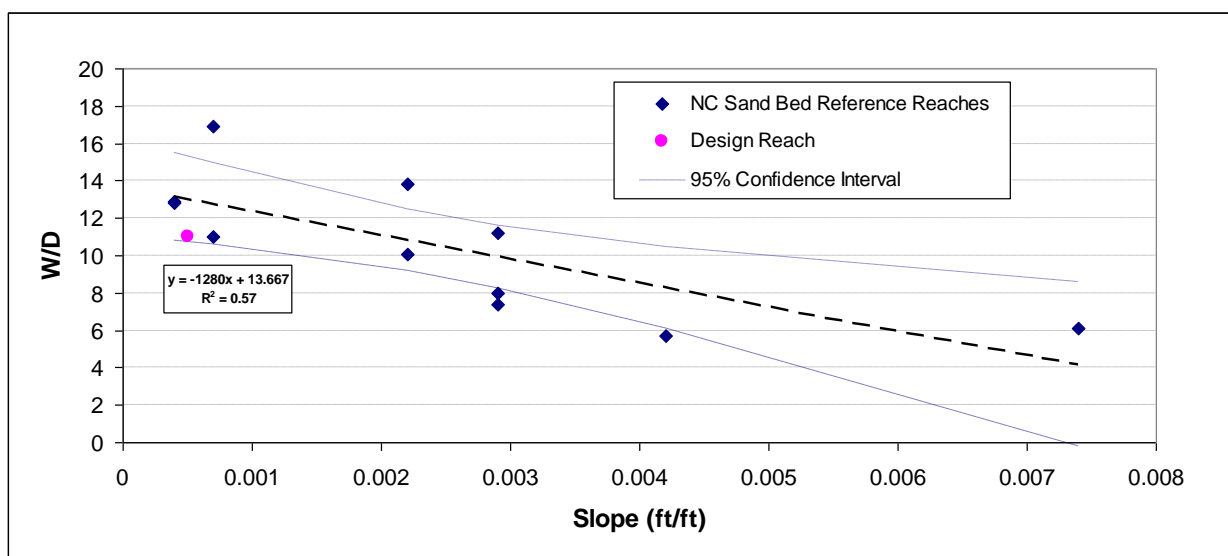


FIGURE 2. REFERENCE REACH WIDTH-TO-DEPTH RATIOS VERSUS SLOPE.

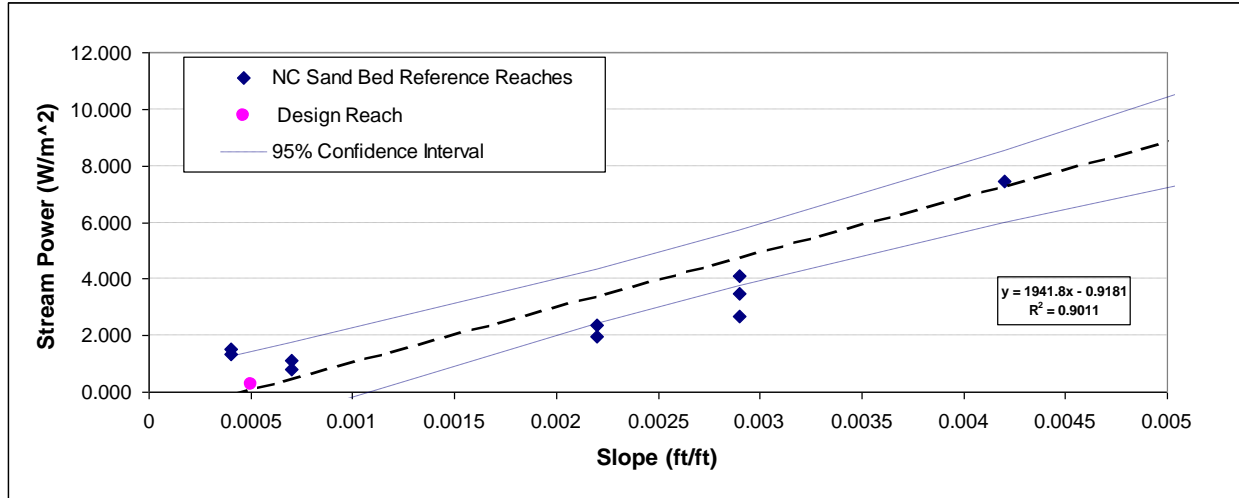


FIGURE 3. REFERENCE REACH STREAM POWER VERSUS SLOPE.

APPENDIX A

EXISTING AND PROPOSED STREAM MORPHOLOGICAL CHARACTERISTICS

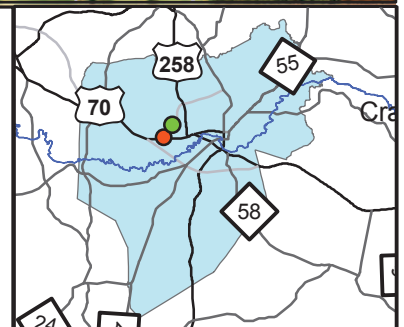
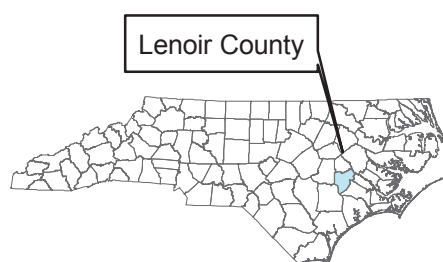
UT to Falling Branch	Existing Stream Values	
Parameter	MIN	MAX
Drainage Area, DA (sq mi)	0.5	
Stream Type (Rosgen)	G5	
Manning's Roughness Coeff., "n"	0.04	
Bankfull Discharge, Q _{bkf} (cfs)	5.0	
Bankfull Riffle XSEC Area, A _{bkf} (sq	7.9	8.1
Bankfull Mean Velocity, V _{bkf} (ft/s)	0.6	0.6
Bankfull Riffle Width, W _{bkf} (ft)	9.3	12.7
Bankfull Riffle Mean Depth, D _{bkf} (ft)	0.6	0.8
Width to Depth Ratio, W/D (ft/ft)	11.0	20.0
Width Floodprone Area, W _{fpa} (ft)	13.2	15.3
Entrenchment Ratio, W _{fpa} /W _{bkf}	1.2	1.4
Riffle Max Depth @ b _{kf} , D _{max} (ft)	1.5	1.5
Riffle Max Depth Ratio, D _{max} /D _{bkf}	1.7	2.3
Max Depth @ to _b , D _{max} to _b (ft)	4.3	7.8
Bank Height Ratio, D _{tob} /D _{max} (ft/ft)	2.3	5.9
Meander Length, L _m (ft)	n/a	n/a
Meander Length Ratio, L _m /W _{bkf} *	-	-
Radius of Curvature, R _c (ft)	n/a	n/a
R _c Ratio, R _c /W _{bkf} *	-	-
Belt Width, W _{blt} (ft)	n/a	n/a
Meander Width Ratio, W _{blt} /W _{bkf} *	-	-
Sinuosity, K	1.1	1.1
Valley Slope, S _{val} (ft/ft)	0.0006	0.0006
Channel Slope, S _{chan} (ft/ft)	0.0005	0.0005
Slope Riffle, S _{rif} (ft/ft)	n/a	n/a
Riffle Slope Ratio, S _{rif} /S _{chan}	-	-
Slope Pool, S _{pool} (ft/ft)	n/a	n/a
Pool Slope Ratio, S _{pool} /S _{chan}	-	-
Pool Max Depth, D _{max} pool (ft)	n/a	n/a
Pool Max Depth Ratio,	-	-
Pool Width, W _{pool} (ft)	0.0	0.0
Pool Width Ratio, W _{pool} /W _{bkf}	0.00	0.00
Pool-Pool Spacing, L _{ps} (ft)	n/a	n/a
Pool-Pool Spacing Ratio, L _{ps} /W _{bkf}	-	-

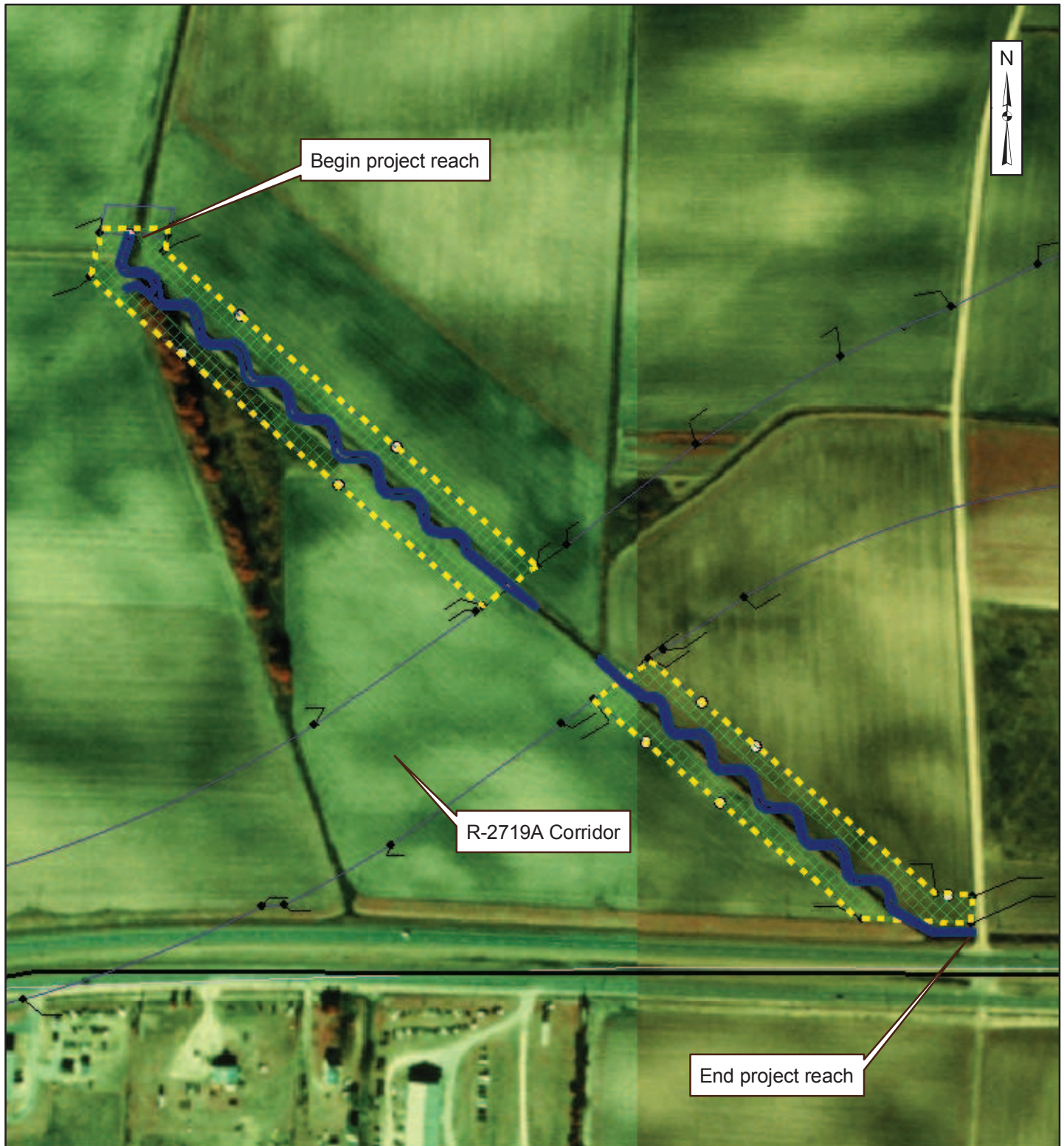
Design Stream Values		
MIN	MAX	MEAN
0.5		
E5		
0.04		
5.0		
8.0	8.0	8.0
0.6	0.6	
9.4	9.4	9.4
0.9	0.9	
11.0	11.0	11.0
80	80	
8.5	8.5	
1.1	1.3	
1.1	1.2	
0.9	1.0	
1.0	1.0	
111	143	
11.8	15.2	
22	30	
2.3	3.1	
50	50	
5.3	5.3	
1.20	1.20	
0.0006	0.0006	
0.0005	0.0005	0.0005
0.0006	0.0009	0.0008
1.2	2.0	
0.0000	0.0000	
0.00	0.05	
1.7	2.6	2.0
2.0	3.0	
12.2	16.0	14.0
1.3	1.7	
23.5	47.0	
2.5	5.0	



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Exhibit 1. Project Vicinity Map





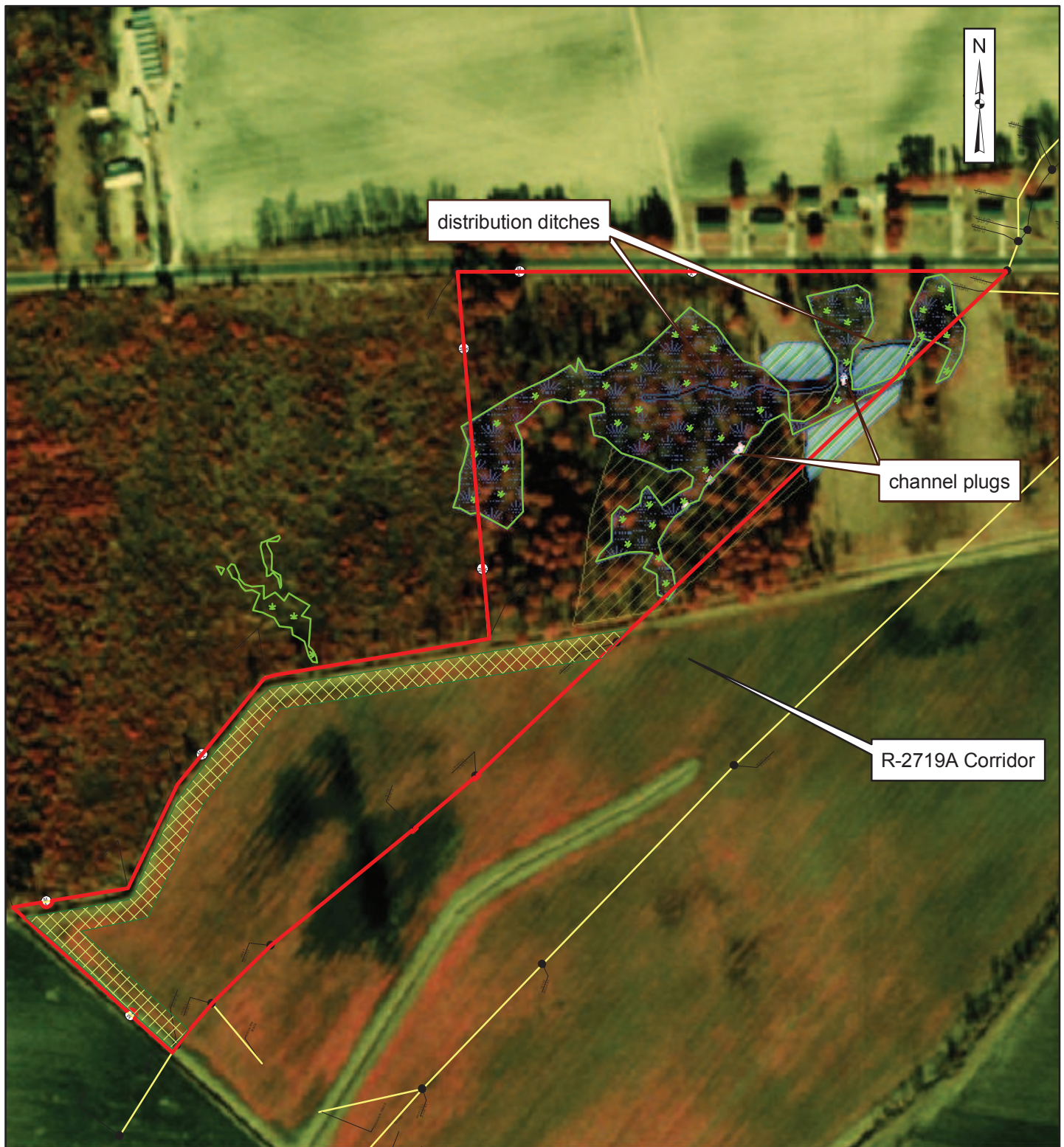
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Exhibit 2. Preliminary Stream Design

200 100 0 200
Feet

Preliminary Stream Design

- Preliminary Stream Design
- Right-of-Way Easement (6.2 acres)
- Riparian Buffer Restoration (3.81 acres)



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Exhibit 3. Preliminary Wetland Design



- Site 2 (21.28 acres)
- Delineated Wetlands (3.96 acres)
- Wetland Enhancement Area (2.07 acres)
- Wetland Restoration Area (0.68 acres)
- Riparian Buffer Restoration (2.10 acres)